NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION WATER CONVEYANCE, STEEL PIPELINE

(feet)

CODE 430FF

DEFINITION

A pipeline and appurtenances installed in an irrigation system.

PURPOSE

To prevent erosion or loss of water quality or damage to land, to make possible the proper management of irrigation water, and to reduce water conveyance losses.

CONDITIONS WHERE PRACTICE APPLIES

The pipeline shall be planned and located to serve as an integral part of an irrigation water distribution or conveyance system that has been designed to facilitate the conservation use of soil and water resources on a farm or group of farms.

All lands served by the pipeline shall be suitable for use as irrigated land.

Water supplies and irrigation deliveries to the area shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application methods to be used.

Scope

This standard covers the design and material requirements for steel irrigation pipelines. This standard does not apply to short pipes used in structures such as siphons, outlets from canals, and culverts under roadways.

CRITERIA

General

Design criteria for this standard is limited to steel irrigation pipeline permanently installed on the ground. These installations are restricted to pipelines not greater than 6 inches in diameter.

Steel irrigation pipelines permanently installed on the ground shall be limited to those locations where the soil resistivity along any portion of the pipelines is greater than 4,000 ohm-cm. Soils classed as having "Low" corrosivity for uncoated steel in the soil survey, Table 2 - Estimated Properties, have a resistivity of 5,000 to 10,000 ohm-cm.

Design criteria for buried pipelines and pipelines installed on above the ground supports is not included in this standard; however, these types of installations may be made if approved by the State Conservation Engineer.

Materials. Steel pipe up to 6 inches in diameter for on-the-ground installation shall conform to ASTM A-120 (Schedule 40). Tables 1 and 2 shown below contain information extracted from ASDI A-120 for Schedule 40 pipe. This pipe shall be galvanized as specified in ASTNI A-120 for corrosion protection and will have threaded joints.

TABLE 1

Dimensions for Schedule 40
Standard Steel Pipe

Size In.	Outside Diameter In.	Wall Thickness In.
½	0.840	0.109
¾	1.050	0.113
1	1.315	0.133
1 - ¼	1.660	0.140
1 ½	1.900	0.145
2	2.375	0.154
2 ½	2.875	0.203
3	3.500	0.216
3 ½	4.000	0.226
4	4.500	0.237
5	5.563	0.258
6	6.625	0.280

TABLE 2

Maximum Working Pressures
Schedule 40 Standard Steel Pipe

Size In.	Maximum Working Pressure	
	psi	Ft.
½	350	810
¾	350	810
1	350	810
1 - ¼	500	1155
1 ½	500	1155
2	500	1155
2 ½	500	1155
3	500	1155
3 ½	600	1390
4	600	1390
5	600	1390
6	600	1390

Working Pressure. The pipeline shall be designed to meet all service requirements without the use of a working pressure which will exceed the values listed in Table 2.

In computing total working pressure, the following items must be considered:

1. The pressure to be delivered at the end of the pipeline.

2. The friction head loss.

3. The elevation differential between the outlet and the inlet of the pipe.

4. Any pressure due to water hammer or surge which may be created by the closure of a valve in the pipeline.

Flow Capacity. The design capacity shall be based upon whichever of the following is greater:

1. Capacity to deliver sufficient water to meet the weighted peak consumptive use rate of the crops to be grown.

2. Capacity sufficient to provide an adequate irrigation stream for the methods of irrigation to be used.

Friction Losses. For design purposes the pipeline friction loss shall be no less than those computed by the Hazen-Williams equation using a roughness coefficient C, equal to 100.

Head losses for fittings and special conditions shall be computed by the equation:

$$H = K \frac{V^2}{2g}$$

where: H = head loss in feet

V = velocity of flow in feet per second

g = acceleration due to gravity = 32.2 ft/sec^2

K = coefficient (see pages 5.5-6 to 5.5-11, National Engineering Handbook, Sec.5, Hydraulics)

Check Valves, Pressure Relief, Vacuum Release, and Air Release. Valves if detrimental backflow may occur, a check valve shall be installed between the pump discharge and the pipeline.

A pressure relief valve shall be installed at the pump location if excessive pressure can be developed by operating with all valves closed. Also, in closed systems where the line is protected from reversal of flow by a check valve and excessive surge pressures could be developed, a surge chamber or pressure relief valve shall be installed close to the check valve on the side away from the pump.

Pressure relief valves shall be no smaller than 1/4-inch nominal size for each diameter inch of the pipeline, and shall be set at a maximum of 5 p.s.i. above the safe working pressure of the pipeline.

A pressure relief valve or surge chamber shall be installed at the end of the pipeline when needed to relieve surge.

Air release and vacuum release valves or combination air release - vacuum release valves shall be placed at all summits in the pipeline, at the end of the line, and between the pump and check valve when needed to provide a positive means of air entrance or escape.

Air release and vacuum release valve outlets shall be at least 1/2inch nominal diameter when specified for lines of 4-inch diameter or less, and at least 1-inch outlets for lines of 5- and 6-inch diameter.

Draining and Flushing Requirements. Provisions shall be made for draining the pipeline completely only if drainage is specified for the job.

If provisions for drainage are required, drainage outlets shall be located at all low places in the line. These outlets may drain into dry wells or to points of lower elevation. If drainage cannot be provided by gravity, provisions shall be made to empty the line by pumping.

Outlets. Appurtenances to deliver water from a pipe system to the land, to a ditch, or to a surface pipe system shall be known as outlets. Outlets shall have capacity to deliver the required flow:

1. To a point at least six inches above the field surface.

2. To the hydraulic gradeline of a pipe or ditch.

3. To an individual sprinkler, lateral line, or other sprinkler line at the design operating pressure of the sprinkler or line.

Pipe Support. For pipelines placed on the ground, the ground shall be shaped so as to provide suitable support.

Thrustblocks. Thrustblocks are required for steel pipelines placed on the ground larger than 4 inches in diameter, Thrustblocks will be installed at all points of abrupt changes in grade, horizontal alignment, or reduction in size. The blocks must be of sufficient size to withstand the forces tending to move the pipe, including those of momentum and pressure as well as forces due to expansion and contraction.

PLANNING CONSIDERATIONS FOR WATER QUANTITY AND QUALITY

Water Quantity

1. Effects on the water budget, especially on infiltration and evaporation.

2. Effects on downstream flows or aquifers that would affect other water uses or users.

3. Potential use for irrigation water management.

4. Effects of installing a pipeline on vegetation that may have been located next to the original conveyance.

Water Quality

1. Effects of installing the pipeline (replacing other types of conveyances) on channel erosion or the movement of sediment and soluble and sediment and soluable and sediment-attached substances carried by water.

2. Effects on the movement of dissolved substances into the soil and on percolation below the root zone or to ground water recharge.

3. Effects of controlled water delivery on the temperatures of water resources that could cause undesirable effects on aquatic and wildlife communities.

4. Effects on wetlands or water-related wildlife habitats.

5. Effects on the visual quality of water resources.

CONSTRUCTION PLANS

Plans for steel irrigation pipeline shall be in accordance with this standard. Plans should include location map, length of lines, size of lines, pipe material, and location of outlets. Also, details on pressure regulators, valves, thrustblocks and other appurtenances should be included in the plans.